

New Distributional Records
of some Northeastern Pacific Opisthobranchiata
(Mollusca : Gastropoda)
with Descriptions of Two New Species

BY

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(12 Text figures)

INTRODUCTION

RECENT COLLECTIONS of opisthobranchs from southern California and the northern shores of the Gulf of California have increased our knowledge of the distributional patterns of certain of these gastropods and provided data for the descriptions of two new species of nudibranchs. Many of these new records add to the list of species indigenous to both the temperate Californian and the northernmost regions of the subtropical Panamic faunistic provinces.

Excluding externally-shelled cephalaspideans and pe-lagic gymnosomes and thecosomes, only a few opistho-branchs have been reported to inhabit both regions. OLDROYD (1927, p. 52) stated that the notaspidean *Pleurobranchus digueti* ROCHEBRUNE, 1895, ranged from the Gulf of California (El Mogote, Bahía de la Paz) to San Pedro. No intermediate localities have been reported nor has the San Pedro record subsequently been verified. The common California sea hare, *Aplysia californica* COOPER, 1863, was tentatively identified from the Gulf of California (El Mogote, Bahía de la Paz, and Puerto Refugio, Isla Angel de la Guarda) by STEINBECK & RICKETTS (1941, p. 541). This species was later recorded by WINKLER (1958, pp. 106 - 107) from several Gulf localities.

Only 11 species of nudibranchs have been reported as common to both provinces. STEINBECK & RICKETTS (1941, p. 544) collected a specimen of *Melibe leonina* (GOULD, 1853) at Puerto Refugio, and LANCE (1961, p. 67) later found it at Bahía de la Paz. The burrowing arminacean *Armina californica* (COOPER, 1862) is known to occur along the coast of Panama, in the Gulf of California, and

from Ensenada to Vancouver Island. In a distributional list of southern California opisthobranchs, LANCE (1961, pp. 64 - 69) added *Diaulula sandiegensis* (COOPER, 1862); *Laila cockerelli* MACFARLAND, 1905; and *Capellinia rustya* MARCUS, 1961, to those species known from both provinces. FARMER & COLLIER (1963, pp. 62 - 63) extended southward the ranges of *Glossodoris californiensis* (BERGH, 1879); *Rostanga pulchra* MACFARLAND, 1905; *Dendrodoris albopunctata* (COOPER, 1863); *Dirona picta* MACFARLAND in COCKERELL & ELIOT, 1905; *Coryphella trilineata* O'DONOGHUE, 1921 (= *C. pinca* MARCUS, 1961); and *Hermisenda crassicornis* (ESCHSCHOLTZ, 1831) to include localities within the Gulf of California.

In view of the impending publication in this journal of a comprehensive guide to the opisthobranchs occurring along the west coast of the continental United States, the present contribution is intended to summarize the current state of our knowledge concerning southern distributions. Two new species are here described in order to make possible their inclusion in the forthcoming keys.

I am deeply grateful to Faye Howard, Fay Wolfson, and Gale Sphon, whose collections from the Gulf of California have greatly facilitated this work. Also I am indebted to James Morin, Lawrence Andrews, Wesley Farmer, and James McLean for providing me with additional data on California species. To Joan Steinberg I wish to express my sincere appreciation for her many valuable suggestions and criticisms during the preparation of this paper. The constant encouragement and profound patience of our editor, Rudolf Stohler, is gratefully acknowledged.

Latitudes and longitudes for the geographical points mentioned are given in the following table.

Alaska		
Sitka	57° 03' N	135° 20' W
Dall Island	55° 00' N	133° 00' W
British Columbia		
Rosepit, Graham Island	54° 08' N	131° 40' W
Nanaimo, Vancouver Isld.	49° 10' N	123° 56' W
Washington		
San Juan Island	48° 30' N	123° 00' W
California		
Tomales Bay	38° 14' N	122° 59' W
San Francisco Bay	37° 47' N	122° 27' W
Monterey Bay	36° 39' N	121° 53' W
Pacific Grove	36° 38' N	121° 55' W
Santa Barbara	34° 25' N	119° 41' W
Santa Cruz Island	34° 01' N	119° 41' W
San Pedro	33° 44' N	118° 16' W
Newport Bay	33° 36' N	117° 54' W
Laguna Beach	33° 32' N	117° 44' W
La Jolla	32° 52' N	117° 15' W
Mission Bay	32° 46' N	117° 14' W
San Diego	32° 42' N	117° 11' W
Point Loma	32° 40' N	117° 14' W
Mexico		
Islas los Coronados	32° 24' N	117° 14' W
Ensenada	31° 51' N	116° 38' W
San Felipe	31° 03' N	114° 50' W
Puertecitos	30° 25' N	114° 39' W
Bahía San Luis Gonzaga	29° 48' N	114° 25' W
Isla Angel de la Guarda (Puerto Refugio)	29° 33' N	113° 35' W
Bahía de los Angeles	28° 55' N	113° 32' W
Laguna Manuela	28° 11' N	114° 04' W
Guaymas (San Carlos)	27° 55' N	110° 54' W
Isla Natividad	27° 53' N	115° 10' W
Punta Eugenia	27° 51' N	115° 05' W
Bahía Tortuga	27° 41' N	114° 53' W
Punta Abreojos	26° 43' N	113° 34' W
Bahía de la Concepcion	26° 43' N	111° 54' W
Bahía de la Magdalena	24° 38' N	112° 09' W
Bahía de la Paz	24° 10' N	110° 17' W
Chile		
Isla de Chiloé	41° 52' S	73° 50' W

SYSTEMATIC LIST OF SPECIES TREATED

CEPHALASPIDEA

Philinacea

AGLAJIDAE

1. *Navanax inermis* (COOPER, 1862)

NOTASPIDEA

Pleurobranchacea

PLEUROBRANCHIDAE

2. *Berthella californica* (DALL, 1900)

SACCOGLOSSA

Elysiacea

ELYSIIDAE

3. *Elysia hedgpethi* MARCUS, 1961

STILIGERIDAE

4. *Stiliger fuscovittata* LANCE, 1962

NUDIBRANCHIA

Doridacea

EUDORIDACEA

Cryptobranchia

DORIDIDAE

5. *Glossodoris californiensis* (BERGH, 1879)
6. *Rostanga pulchra* MACFARLAND, 1905
7. *Thordisa bimaculata* LANCE, 1966, spec. nov.
8. *Conualaevia alba* COLLIER & FARMER, 1964

Phanerobranchia

NONSUCTORIA

NOTODORIDIDAE

9. *Aegires albopunctatus* MACFARLAND, 1905

POLYCERIDAE

10. *Polycera hedgpethi* MARCUS, 1964

SUCTORIA

GONIODORIDIDAE

11. *Okenia angelensis* LANCE, 1966, spec. nov.
12. *Trapania velox* (COCKERELL, 1901)
13. *Ancula lentiginosa* FARMER & SLOAN, 1964

DENDRONOTACEA

TETHYIDAE

14. *Melibe leonina* (GOULD, 1853)



Arminacea

PACHYGNATHA

DIRONIDAE

15. *Dirona albolineata* MACFARLAND, 1912

Aeolidacea

ACLEIOPROCTA

CUTHONIDAE

16. *Cuthona alpha* BABA & HAMATANI, 1963

CLEIOPROCTA

FACELINIDAE

17. *Hermisenda crassicornis* (ESCHSCHOLTZ, 1831)

AEOLIDIDAE

18. *Spurilla chromosoma* COCKERELL & ELIOT, 1905

1. *Navanax inermis* (COOPER, 1862)

This distinctive species has been reported to range from Monterey Bay to Ensenada (MACGINITIE & MACGINITIE, 1949, p. 372). Although in southern California it sometimes occurs along the open coast in rocky intertidal regions and certain subtidal areas to a depth of 33 m, it is primarily an inhabitant of bays and estuaries and in this environment attains maximum size. PAINE (1963) has conducted a unique study demonstrating that *Navanax inermis* is primarily a selective predator of other opisthobranchs and locates its prey by contact chemoreption of mucus sand trails.

Six specimens collected at Laguna Manuela on the west coast of the Baja California peninsula on 8 II 1954 extend the range southward. Field trips to Bahía de los Angeles on 14 IV and 13 V 1964 resulted in the collection of two and three slugs respectively, thus establishing it as a component of the Panamic fauna.

2. *Berthella californica* (DALL, 1900)

1900. *Pleurobranchus californicus* DALL, p. 92
 1927. *P. californicus*, OLDROYD, p. 52
 1948. *P. californicus*, SMITH & GORDON, p. 180
 1957. *P. californicus*, STEINBERG, p. 268
 1961. *P. californicus*, LANCE, p. 65
 1963. *P. californicus*, PAINE, p. 5
 1963 b. *P. californicus*, STEINBERG, p. 69

Occurrence: Monterey (off breakwater), 7 III 1965, one slug obtained by diver at 13 m (Powell, communicated record); Pacific Grove at low tide under rocks, rare

(SMITH & GORDON); San Pedro (type locality), two slugs (DALL); La Jolla, 6 V 1960, two slugs obtained by divers at 33 m (LANCE); Mission Bay (on jetty near entrance), 28 II 1965, three slugs under rocks at low tide (LANCE); Point Loma, 3 IX 1955, one slug under rock at low tide (LANCE).

According to modern systematic concepts of the not-aspidean family Pleurobranchidae, *Pleurobranchus californicus* DALL, 1900, must be transferred to *Berthella* BLAINVILLE, 1825.

In his original description DALL clearly states. "The gill short, its stem finely granular, not tuberculate . . . jaws and teeth as described by Pilsbry for the Gulf of California species collected by Fischer (Man. Conch. xvi, pp. 201-202) . . . The shell itself is white and thin . . . the whole extends more than half the length of the body . . ." PILSBRY reports that Fischer's specimen had "Teeth of the radula simply hooked, with no denticulation."

Contemporary authors (ODHNER, 1939, p. 16; BURN, 1962, pp. 129-131; MACNAE, 1962, p. 168) treating the shelled pleurobranchs appear to agree on a division of the genera based on the configuration of the gill rhachis. In one group the rhachis bears a linear series of prominent tubercles; in the other it is smooth or transversely grooved. *Pleurobranchus* CUVIER, 1805, along with two or three other genera belongs to the former group. The latter group comprises three genera: (1) *Berthella* BLAINVILLE, 1825, with a smooth gill rhachis, hook-shaped radular teeth, and a shell at least half the body length; (2) *Berthellina* GARDINER, 1936, with a smooth gill rhachis, serrate lamelliform teeth, and a shell less than $\frac{1}{4}$ the body length; and (3) *Berthellinops* BURN, 1962, with a transversely grooved gill rhachis, hook-shaped radular teeth, and a shell $\frac{1}{3}$ the body length.

In view of these considerations it is evident that DALL's species with a smooth gill rhachis, hook-shaped radular teeth, and a shell longer than $\frac{1}{2}$ the body length should correctly be known as *Berthella californica*.

Pleurobranchus digueti ROCHEBRUNE, 1895, the only other described pleurobranch reported from the north-eastern Pacific is an entirely different species. It is several times larger, bright orange, and common in the Gulf of California. The only record of its occurrence outside the Panamic province is that of OLDROYD (1927, p. 52) who indicated that its range included San Pedro.

3. *Elysia hedgpethi* MARCUS, 1961

Although a large number of temperate and subtropical species has been assigned to *Elysia* the present form is the sole representative known from the northeastern Pacific.

The original description (MARCUS, 1961, pp. 13-14) was based on three specimens obtained from mud flats at Tomales Bay. LANCE (1961, p. 65) found the species to be a common spring and summer resident in the intertidal regions at La Jolla. STEINBERG (1963b, p. 69) extended the range northward to San Juan Island where it was observed on the green alga *Codium* sp.

The range is here extended to include the Gulf of California (Bahía de los Angeles) where eight slugs were found on *Codium* sp. in the rocky low intertidal region on 14 IV 1964. An additional eight specimens were collected in the same area on 13 V 1964.

4. *Stiliger fuscovittata* LANCE, 1962

This species, originally described from a large number of individuals collected on boat landings in Mission Bay, has recently been reported from a similar habitat at San Juan Island (STEINBERG, 1963b, p. 69). It has been observed only in immediate association with *Polysiphonia* sp. and is presumed to feed upon this red filamentous alga.

Several individuals have recently been collected on clumps of a similar or identical species of *Polysiphonia* in the exposed intertidal region at Bahía de los Angeles on 13 IV 1964. A visit to the same area on 12 V 1964 resulted in the collection of additional specimens and their nido-somes.

5. *Glossodoris californiensis* (BERGH, 1879)

The geographic range of this species has been reported to extend from Monterey to Islas los Coronados off the northern Pacific coast of Baja California (LANCE, 1961, p. 66; STEINBERG, 1963, p. 69). This southern range limit was, however, in error as BERGH (1894) had already reported the species from the region of Bahía Magdalena in the southern part of the peninsula of Baja California.

FARMER & COLLIER (1963, p. 62) subsequently extended the range to include the Gulf of California as a result of obtaining specimens at Isla Angel de la Guarda. Considering the following additional localities from which individuals have been collected, it appears that the species is a fairly common intertidal inhabitant of at least the northern regions of the Gulf: 5 miles north of Guaymas (San Carlos), 6 I 1966, 1 slug; 12 miles south of Puertecitos, 8 VI 1963, 1 slug; 4 miles south of Puertecitos, 20 III 1965, 2 slugs; Puertecitos, 1 IV 1962, 1 slug; 15 miles north of Puertecitos, 8 VI 1963, 1 slug; a few miles south of San Felipe, V 1960, 1 slug; immediately south of San Felipe, 24 III 1963, 1 slug.

6. *Rostanga pulchra* MACFARLAND, 1905

This species appears to occur primarily in the intertidal regions and has been reported to range from Vancouver

Island (O'DONOGHUE, 1922, p. 154) to Point Loma (MARCUS, 1961, p. 15). ELIOT (1907, p. 339) and BABA (1935) synonymized *Rostanga pulchra* MACFARLAND, 1905, with the Indo-Pacific *R. arbutus* (ANGAS, 1864). MARCUS (1958, p. 25; 1959, pp. 36-37; 1961, p. 16) has provided ample evidence for separating the two species. Accordingly, Japan (LANCE, 1961, p. 66; STEINBERG, 1963, p. 70; FARMER & COLLIER, 1963, p. 62) must be excluded from the range.

MARCUS (1959, pp. 35-37) allocated three specimens collected along the coast of Isla Chiloé (Chile) to *Rostanga pulchra*. Whether this remarkably isolated record represents a disjunct population, or simply reflects our almost total lack of knowledge of Panamic and Peruvian opisthobranchs, can only be determined after considerably more collecting has been carried out along the intervening west coasts of Mexico, and Central and South America.

The first record of the occurrence of *Rostanga pulchra* in the Gulf of California was reported by FARMER & COLLIER (1963, p. 62) who obtained several individuals from Isla Angel de la Guarda. Additional specimens from adjacent localities have recently been found at Bahía de los Angeles (13 IV 1964, 2 slugs), Bahía San Luis Gonzaga (5 II 1966, 2 slugs), and 4 miles south of Puertecitos (19 III 1965, 1 slug).

7. *Thordisa bimaculata* LANCE, spec. nov.

1963. ?*Thordisa*, PAINE, p. 4

1963. *Aldisa sanguinea*, FARMER & COLLIER, p. 62

Type locality: Windnsea Reef, La Jolla, California (middle intertidal zone).

Type: The holotype is an entire animal deposited at the California Academy of Sciences, Department of Invertebrate Zoology, where it is registered as CAS No. 100. Four paratypes, CAS Nos. 262, 263, 264, and 265 have been deposited at the same institution. All type material was collected May 31, 1965.

Name: The specific name *bimaculata* was chosen to call attention to the two areas of contrasting dark pigment found on the notum of most individuals.

Occurrence: This species is locally common intertidally along rocky shores of La Jolla and San Diego during the summer. Two specimens were collected at the type locality on 9 XI 1965. On 12 XII 1960, two individuals were taken at 33 m in Carmel submarine canyon (off Carmel, California) by J. McLean (personal communication.) This is the only verifiable record north of La Jolla. FARMER & COLLIER (1963, p. 62) reported this species from Isla Natividad under the misnomer *Aldisa sanguinea* (personal communication).

Description: The average of a large series of adults measured 28mm long 12mm broad, and 6.5mm high. The body is typically doridiform, rounded in front, with nearly parallel sides, and terminating posteriorly in a bluntly pointed tail which extends beyond the notum (Figure 1). The branchiae are completely retractile with-

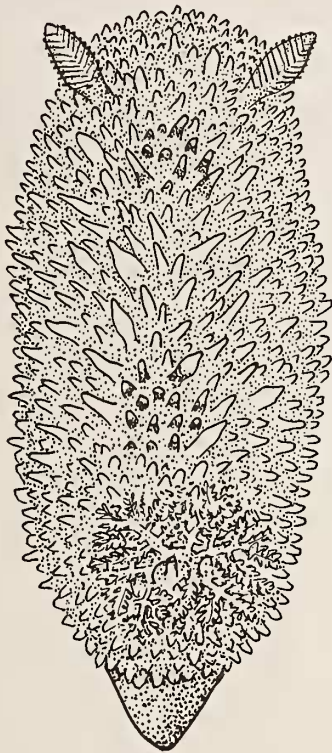


Figure 1

Thordisa bimaculata LANCE
Living animal, dorsal aspect.

in branchial pits. The notum is convex, highest along the midline, and slopes gradually downward to its periphery. The entire dorsal surface of the notum is thickly set with inflated villous papillae longest medianly and gradually decreasing in size outward. In life the larger papillae are constricted near the base, become inflated about halfway up, and terminate in a gradually tapering point (Figure 2). Protruding spicules (Figure 2, b) occur in the constricted areas.

The anterior margin of the foot is rounded and bilabiate with both lips entire, not cleft in life (Figure 3). In preserved material the upper lip often appears slightly invaginated. The foot sides are nearly parallel and covered all around except posteriorly where they taper into a

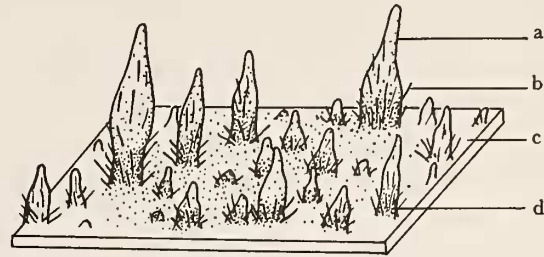


Figure 2

Thordisa bimaculata LANCE
Notal detail in spotted area.

- | | |
|-----------------------|----------------------------------|
| a. papilla | c. notum |
| b. protruding spicule | d. concentration of dark pigment |

bluntly pointed tail which extends for a moderate distance beyond the notal margin. The foot is about $\frac{2}{3}$ the width of the body. In antero-ventral aspect the head region appears only as two broad, fleshy lateral lobes (Figure 3, a) flanking the mouth (Figure 3, b). Two

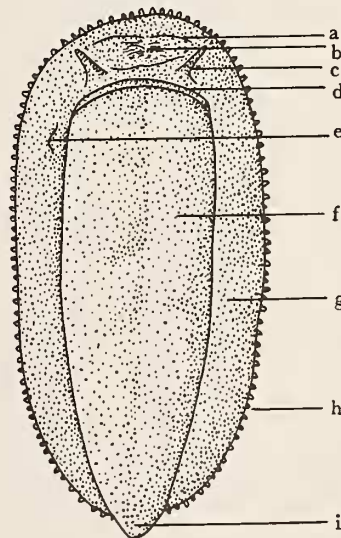


Figure 3

Thordisa bimaculata LANCE
Living animal, ventral aspect.

- | | |
|-----------------------------------|--------------------------|
| a. oral lobe | e. external genital pore |
| b. mouth | f. foot |
| c. oral tentacle | g. hyponotum |
| d. bilabiate anterior foot margin | h. notal papilla |
| | i. tail |

slender digitiform tentacles (Figure 3, c) arise on either side of the mouth somewhat posterior to the lateral lobes. Unlike the ventral cephalic topography of many crypto-branch dorids, the tentacles of *Thordisa bimaculata* are not prolongations of the lateral margins of the oral lobes, but arise independently.

The general ground color varies from bright orange to dull yellowish. A contrasting spot of brown pigment is present along the median line of the notum just behind the rhinophores. A similar spot occurs in front of the branchiae. The pigment in these areas is concentrated primarily on the bases of the papillae rather than on the notal surface. In some individuals the pigmentation is very pale or absent. The rhinophores are darker than the body due to a concentration of brown pigment along the margins of their lamellae. In life, the branchiae are usually lighter than the body in brightly colored individuals, or the same color in paler animals; they are never a contrasting white. In a few specimens the branchial stems may be faintly tinted with purple. The smaller notal papillae are usually tipped with a minute white ring observable only under the dissecting microscope.

The stout rhinophores retract into upstanding papillated sheaths. The stalk is short; the clavus deeply perfoliate with 14 - 16 nearly horizontal lamellae. There is no conspicuous axial septum connecting either the anterior or posterior faces of the lamellae. The clavus is furrowed along its anterior axis and terminates distally in a short cylinder with a flat apex.

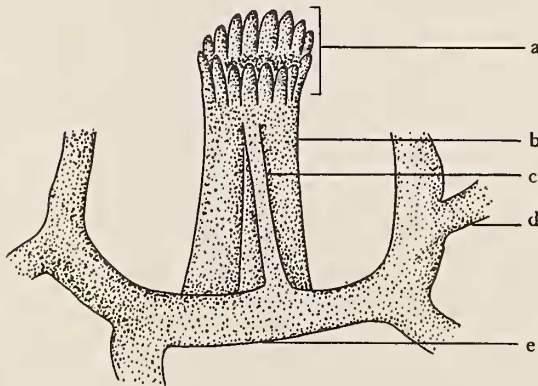


Figure 4

Thordisa bimaculata LANCE

Anal papilla topography, anterior aspect.

- a. convoluted apex
- b. anal papilla
- c. connecting septum
- d. primary branchial stem
- e. branchial base

The six bi- and tripinnate branchiae are upstanding, not spreading beyond the notal borders, and carried at a 45° angle to the horizontal. They are joined at their bases by a prominent horseshoe-shaped septum which is carried above the upstanding tuberculate margins of the branchial pit. The tall anal papilla is located within the cirlet of branchiae and bears a number of creases distally (Figure 4). A distinct septum (Figure 4, c) connects its anterior face to the branchial base (Figure 4, e).

The labial cuticle is strong, nearly transparent, and without any trace of armature (Figure 5). Its surface is tessellated. A typical individual 28 mm in length had a radula formula, 32 x 8-34-0-34-8 at the level of the 17th row. Another specimen of the same length had the formu-

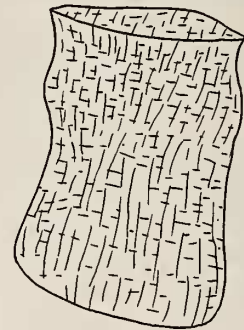


Figure 5

Thordisa bimaculata LANCE
Labial cuticle, lateral aspect.

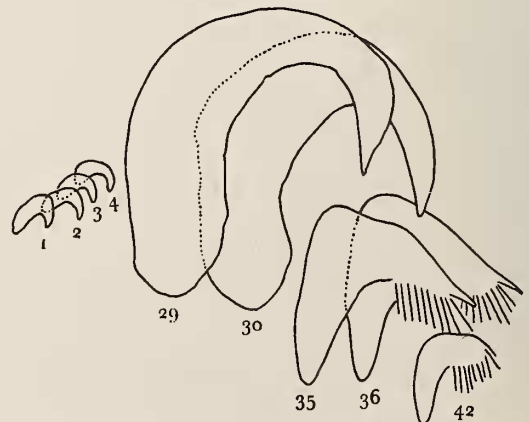


Figure 6

Thordisa bimaculata LANCE

Representative teeth from 16th row of radula.

la 31 x 6-29-0-29-6 at the same level. Several other individuals examined showed only moderate variation in both number of rows and number of teeth per row at any given level. The innermost laterals are small hamate hooks and increase in size outwards. The outermost 6-10 laterals (marginals) abruptly become bristled, bear a prominent cusp similar to that figured for *Thordisa diuda* (MARCUS, 1955, pl. 15, fig. 139), and decrease in size outwards (Figure 6).

The spicules are straight or slightly curved smooth rods (Figure 7). Those occurring around the under surface of the notum form a reticulum similar to that found on the hyponotum of *Dendrodoris albopunctata*.

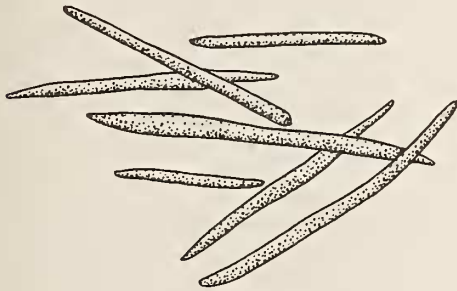


Figure 7

Thordisa bimaculata LANCE
Spicules from notal margin.

The genital apertures are located on the right side at the junction of the notum with the body side and somewhat behind the level of the rhinophores (Figure 3, e). The penis is armed with 7-10 large spines longitudinally oriented (Figure 8, a). Each spine consists of a single large hook arising towards the end of a subrectangular thickened base (Figure 8, b).

The pale to bright yellow nidosomes are flat sinistrally-coiled ribbons of three to five whorls and are attached to the substrate along one edge. The free margin is slightly convoluted. The two individuals collected 9 XI 1965 from La Jolla produced nidosomes with viable embryos in the aquarium as readily as those collected during the summer months.

Specimens with varying amounts of sand grains attached between the notal papillae are often observed in the field. In some cases the animals are heavily encrusted and barely discernible against the substrate. BURN (1957, p. 12) has also noted this phenomenon for the related south Australian species *Thordisa sabulosa*, and concludes that the dorsal papillae extrude an adhesive fluid.

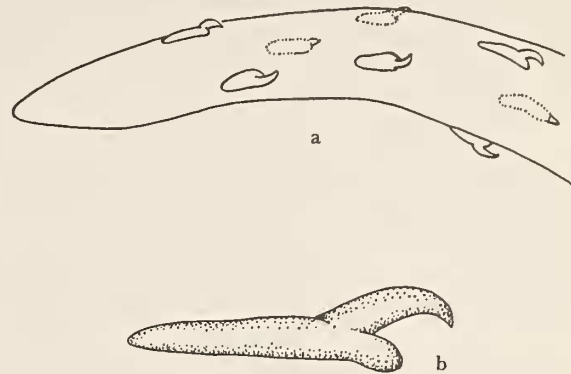


Figure 8

Thordisa bimaculata LANCE
Male genital armature

a. penis with hooks

b. detail of hooks

Thordisa bimaculata is easily distinguished from all other cryptobranch dorids so far recorded from the north-eastern Pacific by the shape and relative size of the notal papillae. Internally the species may be determined by the characteristic arrangement and structure of the radular teeth and penial armature.

8. *Conualaevia alba* COLLIER & FARMER, 1964

This genus and the new subfamily Conualaevinae were proposed by the above authors to receive two new species of cryptobranch dorids with the novel distinction of possessing smooth rhinophores. One of the species, *Conualaevis marcusii*, is known only from the northwestern regions of the Gulf of California. The other, *C. alba*, was reported from intertidal areas at Newport Bay and Point Loma.

Three individuals of the latter species were collected under stones at Bahía Tortuga on 11 IV 1954, extending the range southward along the Pacific coast.

9. *Aegires albopunctatus* MACFARLAND, 1905

This common phanerobranch dorid occurs subtidally, intertidally, and on bay boat landings from Vancouver Island (O'DONOGHUE, 1927) to Ensenada (FARMER & COLLIER, 1963, p. 62). It is one of the most abundant species at least during the summer months in the intertidal regions at Moss Beach, La Jolla, and San Diego.

A specimen noted only as *Aegires* sp. was collected by STEINBECK & RICKETTS (1941, p. 543) in the Gulf of California (Puerto Refugio). Two individuals found

under stones in the low intertidal area at Bahía de los Angeles (13 IV 1964, 1 slug; 13 V 1964, 1 slug) establish this species as an additional component of the Panamic fauna.

10. *Polycera hedgpethi* MARCUS, 1964

The only records of *Polycera hedgpethi* for the Pacific coast of the United States are those from central and southern California. MARCUS (1964, pp. 128 - 131) described the original material from two specimens obtained on *Bugula* sp. in Tomales Bay. Numerous individuals have subsequently been found in San Francisco Bay during the late spring and summer months - also on *Bugula*. One slug was collected in Mission Bay on 18 VII 1964, and another on 10 X 1965, on the same bryozoan species.

At Bahía de los Angeles and its immediate environs this is one of the most abundant nudibranchs, at least during the spring and early summer. At least 50 slugs were observed feeding among colonies of *Bugula* sp. growing on intertidal *Sargassum* sp. on 7 V 1961. Return visits to the area on 14 IV and 13 V 1965 resulted in the collection of numerous specimens. Irregular white egg ribbons, presumably of this species, were abundantly draped among the bryozoan colonies.

11. *Okenia angelensis* LANCE, spec. nov.

Type locality: Bahía de los Angeles, Estado de Baja California, Mexico (lowest intertidal zone).

Type: The holotype is an entire animal deposited at the California Academy of Sciences, Department of Invertebrate Zoology, where it is registered as CAS No. 101. Four paratypes, CAS Nos. 280, 281, 282, and 283, are deposited at the same institution. The specimens were collected 7 May 1961.

Name: The specific name *angelensis* was chosen to indicate the geographic region where the species was first observed.

Occurrence: This species is not uncommon locally and seasonally in its respective habitats. In the Gulf of California it is known only from *Sargassum* sp. beds at Bahía de los Angeles. Six specimens were collected among colonies of campanularian hydroids on 7 V 1961. In California it is an inhabitant of bay boat landings: San Francisco Bay, 3 IX 1964, 1 slug (Andrews, personal communication); Monterey Bay, IX, 1963, 9 slugs (Andrews, personal communication); Santa Barbara Yacht Harbor (a specimen identified from a color transparency); Mission Bay, 31 specimens collected throughout the year 1965.

Description: The largest adult specimen examined was 10 mm long and 2.5 mm broad when actively crawling.

Most individuals were 6 to 8 mm long and 1.5 to 2.0 mm broad.

The body is firm in texture and elongate with high vertical sides and a prominent pallial ridge extending beyond the foot margin (Figure 9). The ridges unite

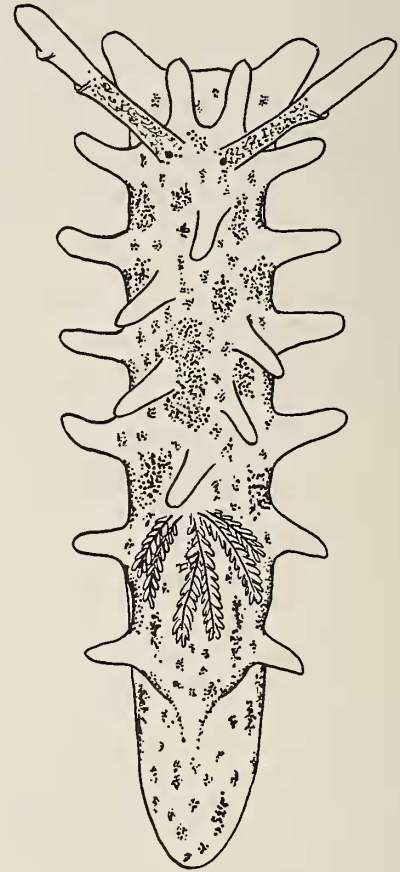


Figure 9

Okenia angelensis LANCE
Living animal, dorsal aspect.

behind the branchiae to form a median crest which rapidly terminates on the flat, rounded tail. Anteriorly the ridges continue in front of and below the rhinophores. On each side the pallial ridge gives rise to 6-9 robust digitiform papillae which project outward in a more or less horizontal plane. Typically, one pair of papillae occurs anterior to the rhinophores, four or five behind the rhinophoral level, and two pairs behind the branchiae. Five or six similar papillae more or less equidistant from each other occur on the notum between the rhinophores and branchiae - primarily on the pericardial hump.

In ventral aspect (Figure 10) the antero-lateral corners of the head are developed into a pair of fleshy, pointed extensions (Figure 10, a). The mouth (Figure 10, b) is a simple longitudinal slit dividing the rounded oral lobes (Figure 10, c). The foot is slightly narrower than the body proper and coalesces along its antero-lateral corners with the body sides to form a simple anterior margin (Figure 10, d). The sides of the foot are nearly parallel and pass backward into a blunt tail.

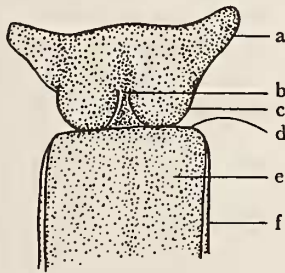


Figure 10

Okenia angelensis LANCE

Living animal, antero-ventral aspect.

- a. antero-lateral head extension
- b. mouth
- c. oral lobe
- d. simply labiate anterior foot margin
- e. foot
- f. side of body

The color pattern is drab and along with the animal's diminutive size renders it very inconspicuous. The ground color is translucent white with the pale yellowish internal organs faintly showing through in the mid-dorsal region. The entire body except the foot sole is sparsely flecked with minute yellowish and white granules. Varying concentrations of reddish-brown dots, often gathered into irregular patches and streaks, occur over this same area but not on the papillae or other appendages except for the proximal half of each rhinophore and occasionally on the principal stems of the branchiae. In some slugs concentrations of subepidermal bluish-green pigment are found along the dorsal and ventral margins of the pallial ridge and on the body sides at the junctions with the foot.

The nonretractile rhinophores are long, tapering rods set apart from each other. Their apices are rounded, not flattened. Most specimens bear one to three incomplete lamellae along the posterior surface of each rhinophore, although these sensory organs are completely smooth in some individuals. No slugs bearing numerous lamellae have been observed.

There are five to seven nonretractile gills separated at their bases. The antero-median member is the largest and is often deeply bifurcate near the insertion of the

primary stem. A similar condition is known to occur in *Okenia evelinae* (MARCUS, 1957, p. 439) and *O. japonica* (BABA, 1949, p. 138). The anterior central gill is usually bipinnate, rarely tripinnate. The following paired members decrease in size and structural complexity with the hindmost pair simply pinnate. The anal opening is on a low rounded papilla and located immediately posterior to the median gill.

The black eye spots are fairly conspicuous and lie buried under the rhinophore bases. The genital aperture occurs high up on the right side under the pallial ridge and between the third and fourth pallial papillae. The penis is unarmed.

The radular teeth are typical for the genus (Figure 11). In a typical specimen 7 mm in length the formula was 21 x 1.10.1.1. The first lateral tooth is hamate with a broad base and on its inner side bears a linear series of 25 - 30 denticles which progressively increase in size from the base of the hook toward its tip (Figure 11, a). The flattened marginal teeth are oval to subquadrangular in

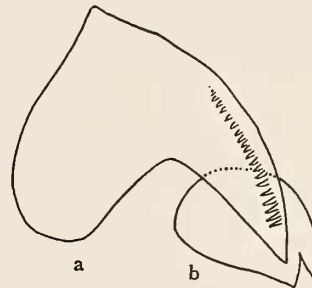


Figure 11

Okenia angelensis LANCE

Representative half row of teeth from center of radula.

- a. inner lateral
- b. outer lateral

outline and bear a single prominent notch, the points of which may be somewhat elongated (Figure 11, b). No jaws or labial cuticle were observed.

Nodulose spicules in the form of elongate irregular rods occur throughout the integument but are concentrated along the pallial ridge and sides of the body (Figure 12).

Remarks: The subgenera *Okenia* with median papillae on the notum, and *Idaliella* without, comprise the phanerobranch genus *Okenia* MENKE, 1830 (MARCUS, 1957, pp. 436, 440). PRUVOT-FOL'S (1954, p. 308) character "... rhinophores longues avec nombreuses lamelles oblique peu prééminentes" must be emended to include the present species with few incomplete lamellae or none.

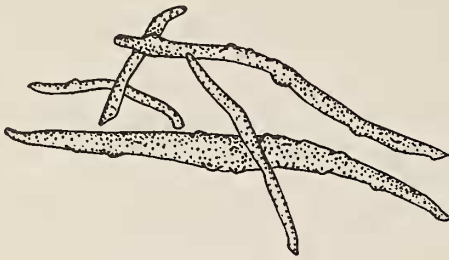


Figure 12

Okenia angelensis LANGE
Spicules from pallial ridge.

MARCUS (1957, pp. 436, 438) listed 15 species of *Okenia* generally recognized as valid. BABA (1960, pp. 80, 81) and HAMATANI (1961, pp. 363 - 365) have since described three new species from Japan. *Okenia angelensis* may be distinguished from all these by its nearly absent rhinophoral perfoliation and color pattern.

Two other members of the genus have been recorded from the northeastern Pacific. O'DONOGHUE (1921, p. 177) described *Okenia vancouverensis* from three specimens "... probably dredged in fairly shallow water of from 10-15 fathoms." obtained off Rosepit, Graham Island (Queen Charlotte Islands). This British Columbia species differs from *O. angelensis* by its deeply perfoliate rhinophores, more numerous notal papillae, much larger size, 14 simply pinnate branchiae, and shape of the radular teeth. It has not been reported since the original description. The other northeastern Pacific species, *O. plana* BABA, 1960, was originally described from specimens obtained along the coast of Japan. During that same year STEINBERG (1960, p. 49) reported *Okenia* sp. from several localities within San Francisco Bay, and later (1963 a, p. 65; 1963 b, p. 71) identified her specimens as belonging to the Japanese *O. plana*. The Japanese species differs from *O. angelensis* by its flattened body with a semicircular head veil, lack of a pallial ridge, single median papilla on the notum, perfoliate rhinophores, greater number of branchiae, highly expanded foot, denticulation of the radular teeth, and color pattern.

12. *Trapania velox* (COCKERELL, 1901)

The brief original description of this species was provided by COCKERELL (1901, p. 87) from a living specimen collected among intertidal rocks at La Jolla. As a result of examining another living individual from the same

locality, MACFARLAND (1929) furnished a more detailed account of the morphology and internal anatomy.

In a recent list of southern California opisthobranchs (LANCE, 1961, p. 67) I reported this species to range from San Diego Bay to San Francisco Bay. However, the latter locality is very doubtful as STEINBERG (1963 b, p. 71) has already pointed out, and we have been unable to verify the original report. Four specimens have recently been identified from the Santa Barbara Yacht Harbor thus confining the presently known range to southern California.

13. *Ancula lentiginosa* FARMER & SLOAN, 1964

This species is known mainly from the original lot of twelve slugs collected in sea water pipes at the Scripps Institution of Oceanography, La Jolla, VI 1963. Two ovigerous specimens were subsequently found (IX 1965) crawling on seawater tables utilizing the same water source. The species has recently been collected at the Monterey Yacht Harbor (Steinberg, personal communication).

On 14 IV 1964 I collected a single adult individual in the rocky intertidal region at Bahía de los Angeles, thus tentatively establishing it as a component of the Panamic fauna.

14. *Melibe leonina* (GOULD, 1853)

Many localities between Dall Island, Alaska (HEATH, 1917, p. 137) and Santa Barbara (COOPER, 1863, p. 60) have been reported for this species (see also O'DONOGHUE 1926, pp. 226-227). During cruises to the kelp canopies (*Macrocystis*) off Point Loma, La Jolla, and Santa Cruz Island, IV 1960 and V 1961, I observed hundreds of specimens actively crawling among the upper blades and stipes of the alga. Characteristic nidosomes were also abundant. Similar observations were made earlier on populations inhabiting kelp beds off Bahía Tortuga (13 IV 1954) and Punta Abreojos (8 IV 1954) on the Pacific side of the peninsula of Baja California.

STEINBECK & RICKETTS (1941, p. 544) were the first authors to report *Melibe leonina* from the Gulf of California. By the aid of a lamp hung over the side of the ship at night they netted a single specimen as "... it was seen swimming past the boat ..." at Puerto Refugio. Subsequently I extended the range to include Bahía de la Paz as a result of collecting a slug found on floating *Sargassum*. Further specimens from attached intertidal *Sargassum* have been found at Bahía de los Angeles (13 IV 1964, 2 slugs; 12 V 1964, 1 slug). A few nidosomes were observed on both occasions.

Melibe leonina does not occur along the open Pacific coast in intertidal regions except accidentally and to my knowledge has never been taken by dredging. It is not uncommon on floating kelp entangled around pilings and boat landings.

15. *Dirona albolineata* MACFARLAND in COCKERELL & ELIOT, 1905

MACFARLAND (1912) gave a detailed description of this spectacular species from material collected along the south shores of Monterey Bay and adjacent coast. It was later reported north to Vancouver Island and south to Laguna Beach (O'DONOGHUE, 1927 b, p. 103). Two large specimens were recently collected by divers off La Jolla at about 30 m (VII 1962). This record extends the range somewhat to the south.

16. *Cuthona alpa* BABA & HAMATANI, 1963

Occurrence: Mission Bay, 10 I 1965, 1 slug; 3 XII 1965, 1 slug; Newport Bay, 25 IV 1965, 2 slugs; Santa Barbara Yacht Harbor, 1964, 1 slug.

Of the four living specimens examined, the largest was 10 mm long and 2 mm broad. The fifth, from Santa Barbara, was identified from a color transparency. All were collected on boat landings in protected waters.

This brightly colored aeolid has been known previously only from the coasts of Japan. A brief description is offered here to facilitate identification by west coast investigators. For additional information and anatomical details see BABA & HAMATANI (1963, pp. 339 - 343).

The body is typically aeolidiform with the cerata given off in five or six overlapping but fairly distinct groups. The anterior two groups each contain three or four rows; those following, a single row each. The cerata are cylindrical, tapering to rounded tips, and without conspicuous cnidosacs. Those more median are the largest. The two most anterior groups originate posterior to the rhinophore insertions, not directly below them.

The rhinophores are simple tapering rods about $\frac{1}{3}$ longer than the cephalic tentacles. There is no trace of perfoliations or annulations in living specimens. Preserved material sometimes presents a "wrinkled" appearance. The conspicuous black eye spots are near the surface of the integument and immediately postero-lateral to the rhinophore insertions. The genital orifice is located on the right side just below the insertion of the most anterior cerata. The anus is interhepatic, i. e. between the right and posterior livers.

The color pattern of this species is distinct and enables it to be readily distinguished from all aeolid nudibranchs described from the northeastern Pacific. The ground color

is translucent white with brown digestive diverticula which form the cores of the cerata and their subnotal connections. For most of its length the antero-dorsal surface of each ceras, except the smallest, is covered with a highly contrasting, intense opaque-white pigment which appears crustose under the dissecting microscope. The pigment is iridescent and reflects primary colors. It also occurs on the dorsal surface of the head as a triangular patch and continues forward between the rhinophores to bifurcate and terminate at the distal end of the cephalic tentacles. Two ill-defined lines of the same pigment run along the sides of the head from the antero-lateral corners of the triangular patch to the anterior insertions of the cerata. Flecks of the pigment occur sparsely on the notum between the cerata. A diffused, bright orange pigment is present on the median half of the dorsal surface of the cephalic tentacles overlaying the deeper white stripe. The distal third of each rhinophore is bright orange. According to the original description of specimens from Japan and my own observations of local material, the intensity of the orange pigment is subject to considerable variation.

Southern California specimens agree in every respect with the description of the Japanese type material and I have no hesitation in identifying the local specimens accordingly.

17. *Hermisenda crassicornis* (ESCHSCHOLTZ, 1831)

Although *Hermisenda crassicornis* inhabits the Pacific coast from Sitka (ESCHSCHOLTZ, 1831) to Punta Eugenia (LANCE, 1961, p. 68; STEINBERG, 1963 b, p. 72), its local distribution in the northern part of the range is unknown. From at least central California south to San Diego it is one of the most common nudibranchs and may be observed in almost any habitat throughout the year. Populations appear to reach their greatest density in the intertidal regions during the spring and summer months, but I have observed vast numbers of copulating slugs and their nidosomes on Mission Bay boat landings during November and December.

FARMER & COLLIER (1963, p. 63) reported a single specimen from the intertidal region at Isla Angel de la Guarda, thus extending the range into the Panamic province. Additional slugs from northern locations in the Gulf of California have been collected at Bahía de los Angeles (6 V 1961, 1 slug); four miles south of Puertecitos (20 III 1965, 1 slug); Guaymas (7 I 1966, 1 slug); and San Luis Gonzaga (5 II 1966, common). The last record is particularly noteworthy because it indicates that substantial populations, not merely stragglers, occur at least in the northern regions of the Gulf. During the same series of minus tides a number of field trips to the inter-

tidal regions of La Jolla and San Diego resulted in the collection of only two individuals of this species.

18. *Spurilla chromosoma* COCKERELL & ELIOT, 1905

The brief original description of *Spurilla chromosoma* is based on a single specimen collected at San Pedro (Deadman's Island - no longer in existence). Although no figures are given, the text description is sufficient to distinguish it from other aeolids from the northeastern Pacific.

During the past several years a large number of individuals agreeing with the original description of *Spurilla chromosoma* has been collected in the intertidal regions of San Diego and La Jolla, and on boat landings in Mission Bay. Additionally, a few slugs have been identified from a protected yacht harbor at Newport. Although never abundant, specimens have been collected throughout the year.

This aeolid is one of the most common nudibranchs inhabiting those regions of the Gulf of California thus far investigated. Specimens have been collected at Bahía de la Paz, 17 III 1954, 8 slugs and nidosomes; Bahía de la Concepcion (7 III 1954, 6 slugs and nidosomes); Bahía de los Angeles (7 V 1961, 12 slugs and nidosomes; 14 IV 1964, common with nidosomes; 13 V 1964, common with nidosomes); Bahía San Luis Gonzaga (5 II 1966, common with nidosomes); four miles south of Puertecitos (20 III 1965, common with nidosomes); and San Felipe (28 XI 1965, 1 slug). This last record is of interest in that it represents the northernmost point in the Gulf of California from which a shell-less opisthobranch has been recorded.

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